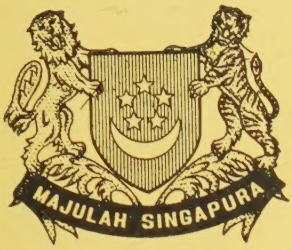

STATE OF SINGAPORE

ANNUAL REPORT OF THE

BOTANIC GARDENS DEPARTMENT

FOR 1961

COMMONWEALTH MYCOLOGICAL INSTITUTE
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STATE OF SINGAPORE

ANNUAL REPORT OF THE

BOTANIC GARDENS DEPARTMENT

FOR 1961

BY

H. M. BURKILL

Director, Botanic Gardens
Singapore

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ADMINISTRATION

I. STAFF

THERE WAS NO CHANGE in establishment during the year and with the filling of the post of Horticultural Assistant in May, senior, research and technical personnel was again at full strength.

II. TRAINING

2. From 11th October to 7th November Mr. Alphonso, attended a course on genetics sponsored by U.N.E.S.C.O. at the National Institute of Genetics in Japan. Miss Chang Kiaw Lan was given an Asia Foundation Award tenable in the United States of America but due to delay in settling the terms on which she could proceed on overseas study, the award could not be taken up.

III. LABOUR

3. An average number of 70 labourers was employed in the Botanic Gardens, 54 in the Istana Negara Domain, 6 men in the Nature Reserves and two men and two women in the Herbarium.

4. During the 26-day strike of Government daily-rated employees in November, 56 labourers in the Botanic Gardens did not report for duty; all other labourers including the entire labour force at the Istana Negara Domain remained on duty.

IV. BUILDINGS AND ROADS

5. The Public Works Department renovated and extended the public w.c. on Lawn D. Roads remained in a good state. The fabric of the herbarium building, however, showed more cracking (see Reports for 1959, paragraph 13, and 1960, paragraph 7), and there was evidence of straining of timbers in the roof. Though the main foundation of the building seems to be solid there is obviously movement which first became apparent in April 1959 and has been continuous since. The state of the building and its valuable contents inevitably give rise to some anxiety.

6. By Gardens' resources a fireproof cement and brick store for petrol and other inflammable articles was constructed near the potting yard; the ruins of an ancient latrine below the Director's quarters on Lawn Z were removed; the Gardens' fence, which is a constant target for sportive youngsters who prefer to make holes through it instead of walking to the nearest gate, was frequently repaired; the sealed-up gate at Liane Road was repaired and opened and a new gate, Holland Gate, was made at the Holland Road end of Tyersall Avenue.

V. VISITORS

7. Many official visitors called at the office including:

Mr. J. S. Womersley, Forest Department, Lae, New Guinea.

Mr. J. A. Bourne, Horticultural Adviser to Air Ministry, London.

Miss Regina Schoental, Medical Research Council Laboratories, Carsholton, England.

Sir Roland Robinson, Chairman, General Council, Commonwealth Parliamentary Association, House of Commons, London, and a keen horticulturist.

Sir Frank Engledow, Emeritus Professor of Agriculture, Cambridge University, England.

Dr. P. C. Spensley, Assistant Director, Tropical Products Institute, London.
Mr. M. D. ffrench Mullen, Director of Agriculture, Mauritius.
E. J. H. Corner, Reader in Botany, Cambridge University.
Dr. A. V. Castillo, Director, Rubber Program, Mexico.
Dr. G. Markovitch, U. N. Technical Adviser.
Dr. Salim Ali, Bombay University.
Dr. G. P. Askew, Soil Scientist, Wye College, England.
Dr. K. N. Kaul, Director, National Botanic Gardens, Lucknow, India.
Mr. A. Dilmy, Director, Herbarium Bogoriense, Indonesia.
Mr. Sadikin Sumintawikarta, Director, Kebun Raya, Indonesia.
Prince Chalermbol of Thailand.
Princess Chumbhot of Nagor Svarga, Thailand.
Mom Chao S. Sonalkul, Bangkok, Thailand.
Nai Tem Smitinand, Royal Forest Department, Thailand.
Mr. J. Wyatt-Smith, Forest Research Institute, Kepong, Malaya.
Dr. J. W. Evans, Director, Australian Museum, Sydney.
Mr. D. Rhind, Department of Technical Co-operation, London.
Dr. A. A. Kirpichnikov, U.N.E.S.C.O., Jakarta.

and many others. These visits afforded occasion for useful and interesting discussions.

8. Many visiting research workers use the facilities of the herbarium, library and Gardens:

Mr. D. H. Nicolson, Cornell University, U.S.A. (Araceae).
Prof. J. E. Canright, Indiana University, U.S.A. (Annonaceae).
Mr. K. M. Kochumen, Forest Research Institute, Kepong. (Herbarium practice).
Mr. Ho Sai Yuen, Forest Research Institute, Kepong. (Art work).
Dr. Harold St. John, Bishop Museum, Honolulu. (Pandanus).
Professor E. C. Abbe, University of Minnesota, and Mrs. L. Abbe, Macalister College, St. Pauls, U.S.A. (Fagaceae and Myricaceae).
Mr. R. B. Kaul, University of Minnesota, U.S.A. (Hydrocharitaceae).
Dr. J.A.R. Anderson, Forest Department Kuching. (Ecology of swamp forests).
Mr. J. Womersley, Forest Department Lae, New Guinea. (Bananas).
Dr. Mamoru Ohashi and Mr. Makoto Togashi, Tokyo Kyoiku University, Japan. (Phytochemistry).
Mr. P. H. Allen, United Fruit Coy, Honduras. (Bananas).

9. The facilities of the Department were made freely available to members of the staff and to sponsored students of the Universities of Singapore and Malaya.

10. The usual very large number of casual visitors came to the Gardens during the year.

VI. CONCERTS

11. The Singapore Police Force band gave eleven concerts during the year by courtesy of the Commissioner of Police. The Ministry of Culture staged one Aneka Ragam Ra'ayat variety show.

VII. PUBLICATIONS

12. Parts 2 and 3 of *The Gardens' Bulletin, Singapore,* Volume 18 were published. Papers for the whole of volume 19 were to hand at the end of the year with little hope of early publication owing to the low priority in the Printing Office accorded to papers of scientific research.

13. During the year papers were published by members of the Department.

BURKILL, H. M.: Protection of Wild Life on Singapore Island, *Malayan Nature Journal*, Special Issue July 1961; An Elephant Affair, *Malayan Nature Journal* 15 (3/4) December, 1961.

SINCLAIR, J.: A new species of Goniothalamus from peat swamp forest in Borneo, *Gardens' Bulletin, Singapore*, 18 (3) December, 1961; Florae Malesianae Precursores—XXXI. The Genus Knema (Myristicaceae) in Malaysia and outside Malaysia, *Gardens' Bulletin, Singapore* 18 (3) December, 1961.

Anonymous contributions were also made to the *Malayan Orchid Review*.

VIII. LIBRARY

14. The Library has remained in very cramped accommodation, partly in the spirit collection room of the herbarium, and partly in the horticultural officers' office.

15. Accessions amounted to 254 volumes of which 231 were journal volumes. There is a very considerable back log of binding; only 53 volumes were bound free at the Printing Office and the small vote for the library precluded any binding being done outside.

16. Revenue from the sale of publications prepared by the Department amounted to $11,475. It is suggested that the revenue from this source for 4–5 years should be set aside for the construction of a proper library building.

IX. AGRICULTURAL PESTS SUPERVISORY COMMITTEE

17. Mr. Burkill, Director, was a member of the Committee.

X. UNIVERSITY OF MALAYA

18. The Director represented the Botanic Gardens on the University Court.

XI. COMMONWEALTH WAR GRAVES COMMISSION CEMETERY, KRANJI

19. The Director, Botanic Gardens, remained the Commission's representative in Singapore. The Botanic Gardens continued to supervise the horticultural and administrative work in maintaining the Cemetery under instructions from the Commission's Eastern Region Headquarters in India. Further information may be found in the Commission's own reports.

XII. NATURE RESERVES

20. The Board of Trustees consisted of:

Nominated by Yang di-Pertuan Negara	1.	Mr. O. K. Abraham.
	2.	Mr. Ong Theng Hong.
The Minister for National Development	3.	Mr. Tan Hoon Siang.
	4.	Mr. Tan Jake Hooi.
The City Council	5.	Mr. Khong Kit Soon.
The Rural Board	6.	Mr. R. Ramalingam.
Chairman *ex-officio*	7.	Director of Botanic Gardens.

21. Normal maintenance of the Reserves was continued during the year. Many people are visiting these areas, especially Bukit Timah. Unfortunately continuous petty damage is done to map holders, path name boards and other facilities by hooligans. It has not been possible to catch the offenders red-handed.

XIII. METEOROLOGICAL

22. Observations were continued at the recording points in the Gardens near the office and in the orchid enclosure. A new station was opened up in July on the summit of Bukit Timah. Records are tabulated in Appendices II, III and IV.

23. The most marked feature of the year was the relatively small rainfall, being 30 per cent below normal. It was the driest year since 1914 when reliable recording was begun in the Gardens. In 1960 the rainfall was 20 per cent below normal and two consecutive comparatively dry years raised serious problems of municipal water supply. The Gardens are however not entirely dependent on mains water and two springs, one on Lawn W and the other on Tyersall Palace land which feeds the Gardens Lake never went completely dry. Except for March and November, rainfall in all months was below average, and in some of them markedly so. The monsoon rains of November 1960/January 1961 failed entirely to materialise, and the monsoon which broke normally in November 1961 did not continue into December, nor into 1962. Other recorded phenomena do not appear to have varied much from normal.

24. The dry weather, as recorded in the 1960 Annual Report (paragraph 23), has continued to produce unusually abundant flowering. Singapore has thereby enjoyed a sample of horticultural delights commonplace in areas where dry seasons are usual. An unprecedented flowering of *tembusu* trees (*Fagraea fragrans*) took place in the early part of the year. This covered much of the Federation of Malaya too.

BOTANICAL RESEARCH

XIV. COLLECTING AND NEW RECORDS

25. A most important expedition took place in June to September on the south and east slopes of Kinabalu in North Borneo. Organised and largely financed by the Royal Society of London, the personnel of the Expedition consisted of:

Mr. E. J. H. Corner, Botany School, Cambridge University (Botanist and Leader).
Mr. Adam Stainton, London (Botanist).
Dr. Chew Wee Lek, Botanic Gardens Singapore (Botanist).
Dr. G. P. Askew, University of London (Soil Scientist).
Prof. J. L. Harrison, Nanyang University, Singapore (Vertebrate Zoologist).
Mr. Chin Phui Kong, Agricultural Department, North Borneo (Fisheries Officer).
Mr. B. E. Smythies, Forest Department, Sarawak (Ornithologist).
'Che Md. Shah bin Haji Md. Nur, Botanic Gardens, Singapore (Plant Collector).
'Che Kadim bin Tassim, Botanic Gardens, Singapore (Plant Collector).
Mr. Ben Ensol, University of Malaya (Hunter).
Mr. Gaun, Sarawak Museum (Hunter).

Messrs. E. J. H. Berwick, Director of Agriculture, E. Carson, Conservator of Forests, and W. Meijer, Forest Botanist, of the North Borneo Forest Service also paid short visits to the expedition. Though the field of work lay in North Borneo, the Botanic Gardens, Singapore, provided a considerable quantity of equipment and a stronger contingent than other organisations more closely concerned with the aims and objects of the expedition—namely to survey the eastern shoulder of Kinabalu in the assistance of the North Borneo Government's proposal to create there a national park. This effort on the part of the Gardens was not by any means selfless. Such botanical surveys further the research of the Department on regional botany and the first set of duplicates after being worked over by experts will come to be deposited

in the Singapore Herbarium. The expedition concerned itself mainly with the eastern shoulder of Kinabalu above Ulu Langanani. From the Ranau Hot Springs the North Borneo Forest Department had opened up a trail leading to five camps: Camp I (Base) at 3,400 feet altitude; Camp II at 6,500 ft.; Camp III at 8,000 ft.; Camp IV at 9,500 ft. and Camp V 10,500 ft. At base camp an Uni-pot aluminium hut was built which served as an office, laboratory and store and soon it acquired the name of "Burlington House", the address of the Royal Society in Piccadilly, London. Plant collections by Dr. Chew Wee Lek were made from Camps I, II and III, while Messrs. Corner and Stainton worked from Camps IV and V. The expedition made no attempt and had in fact no intention of reaching the summit (13,455 ft.), and probably from the eastern shoulder it would have proved to be inaccessible. This shoulder is one of the unexplored parts of the mountain. Virgin forest extends down to about 2,500 ft. From that elevation to about 4,000 ft. the vegetation is montane dipterocarp rain forest. From 4,000 ft. to 6,000 ft. oaks appear and above that the trees become smaller, knarled and merge into Moss Forest with dwarfed trees covered with water-saturated mosses and lichens. Ericaceous plants (rhododendrons and vacciniums) become common above 8,000 ft., and also species of *Nepenthes*, especially *N. lowii*.

26. At the end of July the expedition withdrew from the east shoulder and made its way by contour at about 4,000 ft. across the Sg. Mahmood Valley to Kundasang. Along this trail a species of *Rafflesia* was common.

27. All plant collections made have been sent to the Royal Botanic Gardens, Kew for sorting into families and for distribution to specialists. The Singapore Botanic Gardens will receive Palmae, Araceae, Myristicaceae, Urticaceae and the genus *Ardisia* to work up.

28. A very large number of single day collecting trips were made on Singapore Island and in South Johore, especially by the Keeper whose other work precluded prolonged absence, and by the Mycologist. These trips yielded valuable material but because of their number are not listed. Other expeditions were:

H. M. Burkill	...	Raffles Light and neighbouring islands and reefs ...	28–29/ 1	7 nos.
		Raffles Light and neighbouring islands and reefs ...	3– 5/ 3	7 nos.
		Raffles Light and neighbouring islands and reefs ...	5/ 8	2 nos.
		Raffles Light and neighbouring islands and reefs ...	30/12–2/ 1/62	29 nos
		Bukit Kroh Forest Reserve and P. Undan, Malacca ...	1– 3/ 4	28 nos.
		Tanjong Kling, Pulau Nangka, Malacca ...	28/4–1/5	30 nos.
		Kuantan and central Pahang Road	7–11 /6	33 nos.
		Tanjong Gul, Singapore ...	20/8	33 nos.
		Pulau Besar, Malacca ...	29/8	17 nos.
		Fraser's Hill	2– 7/10	40 nos.
		Cameron Highlands ...	8–14/10	62 nos.
		P. Hantu, Singapore ...	19/11	11 nos.
Chew Wee Lek	...	Cameron Highlands ...	1– 2/4	7 nos.
Chew Wee Lek with U. of Malaya Expedition		Tasek Bera and Temerloh, Pahang	22/10–1/11	42 nos.
A. G. Alphonso	...	Kedah Peak, Penang Hill, Batu Caves	5–16/ 9	21 nos. (also 146 living plants for cultivation)

29. The Director continued collection of marine algae around Raffles Light and extended collections to islands lying off Malacca and at Kuantan. His collections of October at Fraser's Hill and Cameron Highlands were made while on convalescent medical leave. The Cameron Highlands vegetation is but poorly known and the aspect of the area is changing so rapidly that colonies of potentially valuable, rare and scientifically interesting plants may well be snuffed out under the steam roller of 'development' before they have been discovered, let alone studied. Even the Director's small collection of 62 numbers contained new Malayan records and others of plants represented by only one or two sheets in the Singapore herbarium: for example, an *Osbeckia* sp. unmatched in the Singapore herbarium and in the Malaysian collections at Leiden possibly a new species or perhaps an Indian species representing an outflier from the Himalayan flora; *Medinilla penduliflora*, very decorative and collected only twice before; *Lasianthus salicifolius* known from only one previous collection made by Ridley in 1908 on the Telom ridge; *Clidemia hirta*, a South American immigrant spreading over both lowlands and hill stations in Malaya, now collected for the first time at Cameron Highlands; *Pycnostachys stuhlmannii*, an East African plant now running wild. The Director also collected a number of water samples containing phytoplankton for the Director, Fish Culture Research Institute, Malacca.

30. In the single day trips, most attention was paid to the fresh water swamp forest around Mawai, the Gunong Panti and Gunong Pulai Forest Reserves. These areas, each some 40 miles distant from Singapore, are the nearest considerable blocks of forest remaining. Gardens staff took visiting botanists passing through Singapore there and to the Singapore Nature Reserves. Among the noteworthy plants obtained from Johore during these trips, the following may be mentioned: *Crataeva religiosa*, a pretty flowering shrub sometimes seen in cultivation; *Stemonurus malaccensis*; *Dipteris lobbiana*, a rare fern from the Kota Tinggi area, now in great danger of extinction by depredations of picnickers; *Schoutenia accescens*, a tree from Gunong Pulai certainly worth cultivating for its beautiful papery yellow flowers; *Poikilospermum scortechinii*, a rare climber with white flowers; *Phalaenopsis fuscata*, an orchid not seen everyday; *Aquilaria beccariana*, a Bornean element in the drier parts of the swamp forest; *Phaeomaria venusta*, a member of the ginger family with rose-like flowers; *Lepisorus longifolius*, a fern; *Smilax sinclairii*, a common but overlooked plant named after the Keeper of the Singapore herbarium; *Vaccinium leptanthum* and *Maesa macrothyrsa*, the latter relatively rare.

31. Accorded by the Keeper the best find of the year however was a totally different plant. None of those listed above is really new to Malaya nor even to the State of Johore itself. One would scarcely imagine that even now in Singapore, after 140 years of botanical exploration, novelties apart from introduced plants would turn up. This nevertheless is the case for the Director, seeking marine algae in the mangrove mud, and brackish waters of the Sg. Kranji, discovered half buried in the mud the first record for the Malay Peninsula of the semi-marine *Halophila beccarii*. It was there in considerable quantity, but on account of its cryptic habit in a dirty habitat which has little attraction for collectors after less lowly plants, it had certainly escaped notice of all. Also on Singapore Island the presence in fair abundance of *Rhizophora stylosa*, a mangrove tree and certainly not one of microscopic dimensions, was discovered. Ridley recorded it in his Flora as probably occurring at Malacca but the Singapore herbarium has no specimen in substantiation and only two collections of a later date from the Langkawi Islands. It was found at Tanjong Gul, Tanjong Teritep, and on

Pulau Pawai and Pulau Senang. Collections were also made at Malacca on Pulau Besar, Pulau Nangka and Pulau Dodol, one of which must have been the collecting locality of the collections cited by Ridley. This tree is obviously commoner than originally thought.

32. The Keeper also found *Iyengaria stellata*, a new marine algal record for the Malay Peninsula at Tanjong Gul. It has subsequently been found at Blakang Mati. *Monogramma trichoidea*, thought to be extinct on Singapore Island was rediscovered. The locality is not being disclosed since the plant is extremely scarce and should never be taken up by the roots. A rare lycopod, which may be *L. dalhousianum*, has also been found, but unfortunately near a main road where it can be seen by the public. Its expectation of life can only be very limited. There used to be several species of *Lycopodium* in the Water Catchment Area growing on trees as epiphytes but they are fast disappearing. They make decorative hanging plants and have probably been picked for this purpose.

33. More cases of mushroom poisoning occurred during the year and it is now certain that the poisonous species is *Lepiota morganii*. In view of this it is interesting to note the possible identity of *Chendawan Kelemumur* (scurfy fungus) in prescription 523 of "The Medical Book of Malayan Medicine" in the *Gardens' Bulletin* VI (3) October 1930, p.p. 417 and 432. When the commentary on this book was prepared *Chendawan Kelemumur* was unidentified. None of the present cases of poisoning by *L. morganii* has proved fatal, nor more serious than a very unpleasant discomfort of vomiting and diarrhoea. This violent emetic and purgitive action may indeed be a saving grace and the character upon which the Malay *bomoh* relied to shift more potent poisons from the intestines when he prescribed this fungus, adding—where the modern physician would put "Fiat haust" without mention of the outcome—confidentially" . . . and let him be relieved."

XV. EXCHANGE AND ACQUISITION

34. Specimens were again distributed to the usual botanical institutions outside Singapore. The number distributed was 2,672, considerably lower than normal owing to the diversion of botanical staff time to the Kinabalu expedition. Specimens received in exchange or as gifts totalled 2,824 which is also a reduction on previous years. The greatest number came from North Borneo, with the Forest Research Institute, Kepong, second, Herbarium Bogoriense third and the Kuching herbarium fourth. Details are given in Appendix V.

XVI. TAXONOMY

35. Mr. Sinclair continued his work on Malaysian Myristicaceae (Nutmeg Family) in collaboration with the Flora Malesiana Foundation. The manuscript revision of the genus *Knema*, prepared in 1960, passed through the printer and appeared as Florae Malesianae Precursores XXXI. The Genus Knema (Myristicaceae) in Malaysia and outside Malaysia, in the *Gardens' Bulletin*, 18 (3), December 1961.

36. Work was begun on the genus *Myristica*. This is the largest genus of the family with about 70 species and contains the most unsolved problems. Several of the type specimens from New Guinea were destroyed in Berlin during the recent war. Many isotypes have fortunately been located in other herbaria, but some of the destroyed types of which isotypes have not been found elsewhere probably were never duplicated. In some cases a species is known by only one or two gatherings and the material is inadequate for a good description to be made. Nor do these sheets bear detailed field notes on the general appearance of the tree, bark characteristics and other features.

Useful work is being done by botanists of the land utilisation section, C.S.I.R.O., Canberra, and of the Forest Department of New Guinea, but it is desirable that the monographer who is engaged on such work should see for himself the living trees in the forest. It is hoped that arrangements now being made to send Mr. Sinclair to New Guinea in 1962 will be successfully concluded.

37. Dr. Chew's work on the Urticaceae was held up by his participation in the Royal Society Kinabalu Expedition. However the work on the genera *Fleurya* and *Laportea* reached an advanced stage of preparation. As in the case of the *Myristica* types, there is difficulty locating and examining type collections of the genera under review which, if they still exist are laid in European herbaria. This would normally be resolved by the monographer visiting the relevant institutions and it is hoped that in a year or two's time this will be possible. The Botanic Gardens are greatly indebted to Miss P. I. Edwards, Librarian, of the British Museum of Natural History, and to Dr. Ding Hou of Flora Malesiana Foundation, who have supplied photocopies of critical literature not available in Singapore.

38. Miss Chang collected fungi and was particularly occupied with the genus *Lepiota* which, as recorded elsewhere in this report, was the cause of poisoning. Two hundred and thirty seven numbers of fungi were added to the mycological herbarium. Seventy two illustrations were added to the *icones fungorum*.

39. Dr. Furtado, now on retirement and working on a voluntary basis, determined material sent over from the Kuching herbarium, some of it classical collections of Haviland and Hose.

40. Determination of material received from other institutions proceeded satisfactorily, and inspite of the absence of herbarium staff on the Kinabalu Expedition good progress was made with naming Mr. Ashton's large collections from Brunei. This is the first really comprehensive collection of forest trees from Brunei and so fills a gap in our knowledge of the Bornean flora.

41. Routine mounting, repairing of damaged sheets and poisoning were continued without break. Three mounters are now employed and inroads are being made into the backlog of specimens awaiting mounting. Some 3,000 sheets were prepared and laid in.

XVII. LOANS OF HERBARIUM MATERIAL

42. Nine loans were made, all in connection with monographic revisions for *Flora Malesiana*. The Rijksherbarium, Leiden, took 950 sheets of Sapindaceae, Sapotaceae, Ochnaceae, Primulaceae, *Pisonia*, *Pygeum* and *Ormosia*. Canberra took 706 sheets of Saxifragaceae and Monimiaceae. Sheets received on loan were 1,280 Myristicaceae for Mr. Sinclair's work. They came from the University of California, Royal Botanic Gardens, Kew, Kuching Herbarium, Arnold Arboretum and the Rijksherbarium, Leiden.

HORTICULTURE

XVIII. GARDENS MAINTENANCE

The Lake

43. The main horticultural work was carried out in June, July and August when the dry weather and the reduced flow of water into the Lake gave the opportunity for draining it for repairs to the crumbling banks at the upper end, and for the removal of an accumulation of silt. An average of 40 labourers daily were deployed from their usual duties on this work. A coral boulder wall was made around the head of the Lake. Considerable quantities of mud and silt were removed and put in the Dell Rockery. Bridges

over the silt pits were repaired and seats put up at the head of the Lake giving a vista down its length. The silt pits were also cleaned out and repaired.

44. The lowering of the water level in the Lake also facilitated further investigation into the mystery of the complete disappearance of the waterlily population recorded in previous reports (1959, paragraph 76; 1960, paragraph 69). As soon as the water level had receded to a small muddy area at the lower end, sweep netting was undertaken to trap the turtles. The presence of the Malayan Leathery-backed Mud Turtle (*Trionyx cartilagineus*) was known and zoologists protested its carnivorous innocence, an alibi soon to be substantiated by the discovery of a second species of turtle that had no such horticulturally benign character. The other species was found to be *Callagur borneoensis*, an animal of known vegetarian habits. Some half dozen of this species were caught, one or two weighing over 50 lb. and their removal from the Lake subsequently led to such an overwhelming regeneration of *Nelumbium* and *Nymphaea* as to be a little embarrassing. That only half a dozen turtles could keep down the growth of these waterlilies dispersed thickly over about 3 acres of water is quite remarkable.

45. Almost as soon as the mud was exposed by draining the Lake germination of *Nymphaea* began and soon a complete mat of plants was formed. These must have come from a rich stock of seeds lying dormant in the mud for at least five years and which drying or an improved aeration stimulated to germinate. Material long thought lost was soon identifiable, for example, a blue *Nymphaea* which last flowered in 1953 reappeared in exactly the same spot in which it was then planted.

46. While the *Nymphaea* was early to reappear, the *Nelumbium* did not start to grow till water had begun to accumulate again in the Lake. It very soon became rampant and strong measures had to be taken to curb this untidy plant and to prevent it completely smothering the desirable *Nymphaea*. Spraying the leaves with Agroxone, followed 2 weeks later by hand pulling of the unsightly trash and then by patrol rounds to catch the few regenerating survivors gave a very excellent degree of control. The surface-lying leaves of *Nymphaea* with careful handling of the spray escaped damage.

47. Besides the six *Callagur borneoensis* turtles, ten *Trionyx cartilagineus* were also caught. All 16 were distributed to the University of Singapore, the National Museum, the Van Kleef Aquarium or to the Water Department. At the same time nearly 100 specimens of a fish called "Aruan" (*Chanos micropeltes*) were caught and distributed, but many were left. Acknowledgement is made to the Director, Tropical Fish Culture Research Institute, Malacca, for a supply of *Tilapia zillii* fingerings on whose advice the Lake has been restocked.

Horticultural Work

48. Thirty new beds were dug and borders reconditioned. The canna beds along the Main Gate Road were manured and replanted. The thick undergrowth along the road boundary of Lawn A was cut back and removed, exposing an interesting banyan (*Ficus retusa*) with many thick and long root stems. The following plantings were carried out: *Amherstia nobilis*; Bougainvillea 'Easter Parade'; *Lodoicea seychellarum*; *Solanum wrightii*; *S. wendlandii*; *Cassia spectabilis*; *Adenium coetanium*; *Nymphaea* yellow variety; *Victoria regia*; *Cydista acquinoctalis*; *Ipomoea tuberosa*; *Durio zibethinus*; *Ochroma lagopus*; *Jacquemontia violacea*; *Coreopsis coronata*; *C. delphinifolia*; *C. lanceolata*; *Rudbeckia laciniata*; *R. hirta*; *R. fulzida*; *R. laciniata*; *R. hybrida*; *R. maxima*; *R. amplevicaulis*; *Dianthus cassius*; *D. giganteus*;

Hibiscus trionum; *Asclepias curassavica*; *Mutisia oligodon*; *Gaillardia pulchella*; *G. aristata*; *Verbena grandiflora*; *Salvia officinalis*; *S. sclarea*; *Platycodon manesii*; *Gerbera anandria*. Most of these are annuals. Planting of permanent plants such as trees is severely limited by lack of space.

49. In collaboration with the United Fruit Company of Boston, U.S.A., who sent a team of specialists to Malaya to collect genetic material of bananas (*Musa* spp.) for their breeding programme on their estates in Honduras, the Botanic Gardens established a duplicate set of their material. This is now being multiplied for distribution in Singapore and Malaya, but because of the amount of space this stock requires at the expense of other horticultural material in the Gardens' nursery it cannot be maintained after the initial distribution has been done. This situation clearly illustrates the way the useful and economic function of the Botanic Gardens is severely limited by shortage of space.

50. Another introduction of commercial potential was seeds of *Macadamia ternifolia* from Hawaii, but because of lack of space only ten plants were established and probably eight of these will have to be thinned out as the trees grow larger. Some of the seeds acquired were passed on to the Federation Department of Agriculture. This species produces an edible nut which is finding increasing use in confectionery. It was introduced into the Botanic Gardens in the last century but without success. The tree is very variable. Selected clones are cultivated in Hawaii and in tropical Queensland. There is no obvious reason why selected seedlings, which later could be cloned, should not do well in Malaya provided the selection can be done over a large enough population of seedlings.

51. Casualties during the year included: *Chrysalidocarpus decipiens*; *Adomidia muellerii*; *Shorea bracteolata*; *Elaeis guineensis*; *Talauma candollei*; *Meloccana bambusoides*; *Actinophloeus angustifolius*; *Aleurites moluccana*; *Araucaria cunninghamii*; *Fagraea fragrans*; *Acacia magnum*; *Theobroma cacao*; *Bassia madhuca*.

52. The six motor mowers gave good service and the lawns were maintained in top condition except during the 26-day strike of Government daily-rated employees when mowing was stopped. An interesting point of natural history was observed during this period. Frequency of mowing is normally weekly. With the cessation of mowing, *Eragrotis amabilis* and *Axonopus compressus* which together make up most of the turf began to flower. Normally there is little or no grass seeding in the Gardens and grass seed eating birds are not often seen, but during this period it was a delight to see small flights of white-headed and black-headed munias working across the lawns.

Composting

53. Our friend, the bountiful elephant, whose productiveness has been commented on in previous reports (1959, paragraph 80; 1960, paragraph 73) regarding the preparation of compost was followed in a rather dramatic manner by the Comptroller of Customs. Notwithstanding the official status of the Comptroller and that the material with which he supplied the Gardens was above suspicion, considerable embarrassment as is recorded below was suffered both on receipt of Comptroller's generosity and all along the line in processing his product, but when it was finally made it certainly had more than a little of the good things in it that plants like.

54. Occasionally the Comptroller had sent small consignments of confiscated tobacco to the Gardens for composting and these had been readily absorbed and lost in the considerable quantity of vegetable debris which all the time is being processed. However, some time early in the year, without much warning, eight tons of tobacco, impounded by the Customs on a false

import declaration and ordered to be confiscated by the Courts, arrived at the Gardens just as the day's work was ending. All available hands were summoned and compost heaps were prepared non-stop for the next three days under the eye of Customs officers and until the officers were satisfied that the tobacco was beyond pilfering. Even then eight tons goes a remarkably long way!

55. Tobacco leaf which has been prepared for smoking is treated with added chemicals which may well be preservative, and it would seem that the normal course of decomposition in the heaps, which were scarcely diluted with other trash, did not occur. Heating went wrong and instead of heaps sterilised by heat they became first-class breeding clamps for flies and there was a localised plague of flies in the Gardens area. Tobacco, as everyone knows, contains nicotine, and nicotine is a powerful insecticide, but it was obvious that in this form it was ineffective. The expectation of effectiveness expressed in the Departmental Report for 1960 (paragraph 66) has not been fulfilled. Further evidence of the absence of insecticidal properties was to be had from attempts to dress lawns infested with small black viciously-biting ants with the tobacco dust. This proved quite useless and left the lawns reeking of the death-like smell of stale tobacco smoke. Nevertheless the compost when eventually completely processed was first class horticultural material.

56. Inspite of the difficulties outlined above, which were really teething troubles in handling a novel commodity in virtually a pure state, the Gardens are willing and ready to accept more. In fact acknowledgement is here given to the Malayan Tobacco Company for the regular supplies of sweepings from their factory which being received in more moderate quantity at any one time constitutes a welcome addition to our usual composting mixture.

XIX. PESTS AND DISEASES

57. The trouble caused by Rhinoceros Beetle (*Oryctes rhinoceros*) and Red Stripe Weevil (*Rhyncophorus ferruginea*) recorded fairly regularly in previous reports, has been very much less. Nevertheless constant watch has to be maintained and regular prophylactic dressing of palm crowns with insecticide has been done. However, *Cytostachys lakka* and *Roystonia regia* have been badly attacked by another pathogen the identity of which has not yet been determined. The leaves turn brown and die back to the stem. After that the stem also dies. Investigation into the cause is still being conducted.

58. The long-tailed macaque (*Macaca irus*) remained the most troublesome pest and against which little can feasibly be done. The Gardens were issued with a new shot gun and three monkeys were shot at points where most damage was being done, but the "bandarlog" (to quote Rudyard Kipling in *The Jungle Book*) ". . . have no remembrance . . . their memories would not hold over from day to day . . .". The effect of such defensive plant protection is but short lived.

59. An interesting effect of the prodigious flowering of the *tembusu* trees (paragraph 25) was an unusually heavy fruit-set which was quickly discovered by the flying foxes (*Pteropus edulis*). For the previous few years these animals have come in from outside during the season to feed on the *tembusu* fruit and squabble the night through returning at dawn to roost outside again. This year several hundred of them found it to their convenience to roost in the Gardens' jungle where they stayed for about a month. Then one morning early in September they failed to settle and weaved about over the Gardens in a most restless manner till about 10 a.m. when the whole flight took off together and were gone.

60. During the year the Director of the National Museum, Singapore, found a thriving colony of *Amphidromus inversus* (Muller) on the trees by the potting yard. This is a snail known to occur in the Riau Islands and but dubiously reported from Malaya in a single record of many years ago. This is certainly the first record of it in Singapore. The size of the colony found shows that the snail is established and is able to reproduce itself. There is no indication so far, that the snail is troublesome, but till its habits are better known it will have to be watched. In appearance the shell is not unlike that of the Giant African snail (*Achatina fulica*) but it has a reflexed rim to the opening by which it can at once be distinguished.

XX. HORTICULTURAL EXCHANGE

61. Seed and plant exchange with other botanical organisations in Singapore, Malaya and overseas was again an important aspect of the work of the Horticultural Division. Two persons were engaged full time on seed and plant collection in fulfilment of requests. This work is done on a mutual exchange basis and our output is requited by receipts in response to our own requests. Material was sent to 159 addresses in 43 countries and received from 114 addresses in 39 countries, which are listed in Appendices VI and VII.

XXI. ISTANA NEGARA DOMAIN

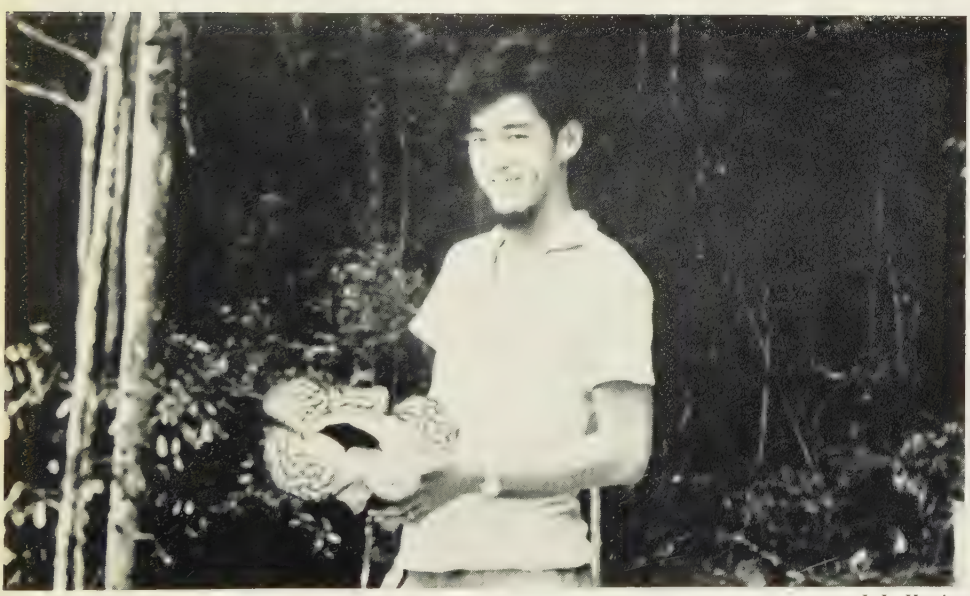
62. Supervision of work at the Domain has not been easy owing to the transfer of the Junior Horticultural Assistant and the retirement on medical grounds of the Foreman Gardener. The latter post was filled in July. In May the post of Horticultural Assistant on the Gardens establishment was filled and this officer was placed in charge of the horticultural work of the Domain.

63. The grounds, including the immediate gardens of all the houses in the Domain, have been kept in good condition. The three Dennis motor mowers gave excellent service on the lawns, and so did the motor scythes in the outlying rougher areas. Outdoor receptions, especially in the garden of 'Sri Temasek' raised a problem of ant control, for the lawns there are infested with a small viciously-biting ant. Heavy dosing with an insecticide just before a reception would give very brief control. The outbreak of *Elephantopus scaber* recorded in last year's report (paragraph 72) has been checked. The use of a selective weed killer was found to be not only expensive but not efficient enough. Hand weeding has the plant under control, but as the seeds are wind-distributed and the plant is ubiquitous in Singapore, constant patrolling is necessary. A number of old trees were pruned or removed for safety. New plantings were restricted because of the severe drought. Preparation of compost was again a major item of work and the quantity of vegetable debris from the Domain was inadequate for the amount of compost required. Spent hops from a local brewery were a welcome addition to the compost heaps. The potting yard has maintained a stock of some 2,000 potted plants for use as house decoration, not only in the Istana, but in the other houses within the Domain, and also for use as bedding-out material. Additional orchid beds were planted.

64. The Domain grounds were open to the public on New Year's Day (January 1st), Chinese New Year's Day (February 15th), Hari Raya Puasa (March 18th) and on Labour Day (May 1st).

H. M. Burkill

Plate 1. *Rhizophora stylosa* Griff. on rocky shore line off Pulau Dodol, Malacca. See para. 31.



J. L. Harrison

Plate 2. Dr. Chew Wee Lek, Botanist, holding a flower of *Rafflesia* sp. aff. *R. schadenbergiana* Goepp., Mt. Kinabalu, Borneo. July 1961. See para. 26.

Composting cigarette tobacco. See paras. 53–56.

H. M. Burkill

Plate 3. Preparing compost heaps.

H. M. Burkill

Plate 4. After regeneration of *Nelumbium* and *Nymphaea.*

H. M. Burkill

te 5. *Callagur* borneoensis responsible for browsing down the water lily population of the Gardens Lake.

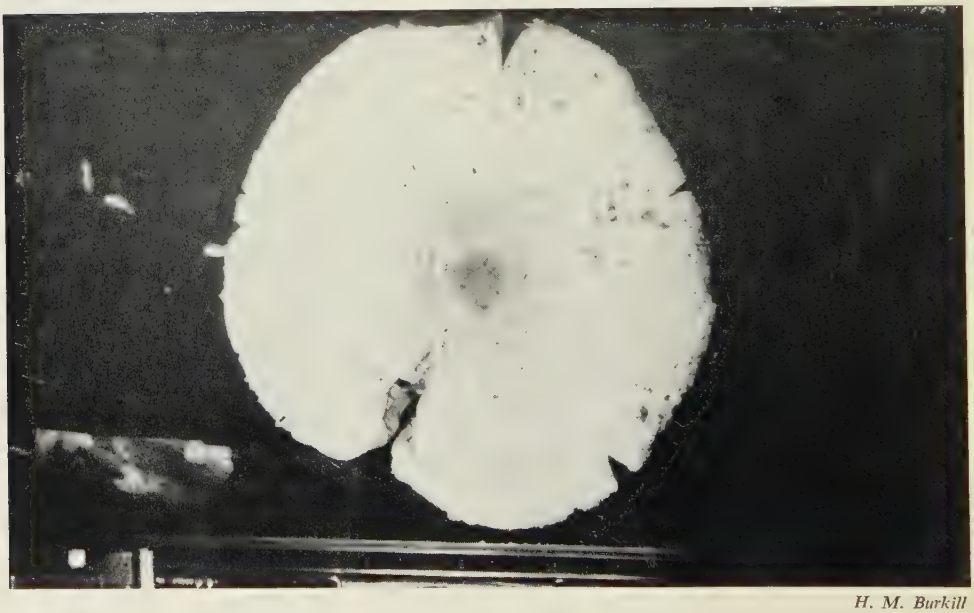
H. M. Burkill

Plate 6. *Micropeltes chanos* "Aruan", also found in the Gardens Lake.

Lepiota morganii to which poisonous properties are attributed. See para. 33.

H. M. Burkill

Plate 7. Note gills free from the main stem, and prominent collar on it, which will become free on ageing.



H. M. Burkill

Plate 8. In surface view. Note scurfy appearance.

Changi Cottage

65. The Curator in charge of the Domain also visited and gave advice on the maintenance of the garden at Changi Cottage.

Singapore House, Kuala Lumpur

66. The Domain nursery was used to prepare planting material for the garden of this house. These amounted to 1,500 pots excluding hedging material. The Curator visited Kuala Lumpur on 6th November, with the Superintendent, City Parks, and the P.W.D. architect to prepare landscape plans.

XXII. ORCHIDS

67. The collection of species and hybrids continues to expand. Seventy-two field numbers were collected by Gardens' staff while on field work at: Gunong Pulai, Johore; Cameron Highlands and Fraser's Hill, Pahang; Pulau Undan and Pulau Nangka, Malacca; Ulu Gombak, Selangor; and Kedah Peak. Others were received from outside sources, in particular from Sarawak, Brunei, North Borneo, New Guinea, Nepal and Costa Rica. *Dendrobium longicornum* received from Nepal obligingly flowered at Singapore six months after receipt. The collection was greatly added to by exchange: 260 plants, cuttings and seedlings were received and 257 given. Individuals and organisations concerned are listed in Appendices VI and VII.

68. Sixty-one hybrid pods were harvested from the Gardens nursery, five were received from Singapore growers, four from the Federation of Malaya, eight from Queensland, Australia, one from Sarawak and seven from the U.S.A. Of these 86 pods, seed from 80 have been successfully germinated. Excellent results have been achieved with the use of banana pulp added to the flasks and growth of seedlings is accelerated. Good results have also been achieved with addition of a sterilised aqueous solution of "Foliar Gaviota" (1 gm. in 500 ccs.) to the flasks containing older seedlings.

69. Over 1,000 flasks were constantly in use during the year. Seedlings from 500 were planted out in "community" pots. Manuring and insecticide and fungicide spraying was conducted on a weekly basis throughout the year. Root and foliar manuring was alternated weekly. Two efficient proprietary fungicides were also alternated weekly. One thousand seedlings from the houses went out into the open or into beds.

70. The problem of space in the orchid nursery becomes more acute. This was commented on in the Gardens' Report for 1960, and its repetition here is no cry of "wolf". The time when saturation in the nursery will be reached is in sight. There is already a shortage of seedling houses and accommodation asked for has not been approved. Seedlings which should be potted on from the flask stage have had to be held back in the flasks. Thus is frustrated the speeding up of growth in the flasks referred to above (paragraph 69) which has been achieved by diligent research. And at the mature stage new Aranda and Arachnis plants which should be grown in beds—and multiplied for sale to the public and industry—have had to be retained, and retarded, in pots. The Botanic Gardens has pioneered orchid research in Malaya and a growing orchid nursery industry has come into being because of this work. Not one of the commercial nurseries, nor even an amalgamation of nurseries has the combination of facilities and knowledge that are at the disposal of the Gardens. Without research this promising industry will stagnate and die. If the Botanic Gardens are to continue to serve the industry its activities have created, more land to accommodate the living collection must be provided.

71. The following, which first flowered in 1960, were registered during 1961:

BGS—

2441 Dendrobium Verninha (*D. undulatum* var. *broomfieldii* × *D. d'albertissii*).
2261 Dendrobium Loke Looi Chiew (D. Medusa × D. Constance).
2255 Vanda Wee Kim Lian (*V. limbata* × *V. lamellata*).
1268 Vanda Mark Shou Young (*V. dearei* × *V. luzonica*).
2327 Dendrobium Helen Loke (D. Medusa × D. Ursula).
2325 Dendrobium Lin Yoke Ching (D. Louisae × D. Constance).

and flowering in 1961, two crosses were also registered:

BGS—

2405 Aeridovanda Chiun Hai Cheok (Vanda Kapoho × *Aerides quinquevulnerum*).
1931 Arachnopsis Khalsom (*Arachnis hookeriana* var. *luteola* × *Phalaenopsis violacea*).

A further six flowered, and registration names have been proposed:

BGS—

2684 Vandanthe Bellasan (Vanda Rubella × *Euanthe sanderiana*).
2619 Dendrobium Ng Keng Soon (D. Emma Mathieu × D. Constance).
2482 Vanda Felix Quek (V. Josephine van Brero × V. Oriole).
2654 Arachnopsis Napier (A. Eric Holttum × *Phalaenopsis denevei*).
2452 Aranda Majula (Arachnis Maggie Oei × *Vanda insignis*).
1809 Vanda Nellie Corbett (V. Ruby × *V. insignis*).

and flowered without action to register:

BGS—

2290 *Dendrobium strebloceras* × D. Constance.
2687 Dendrobium Caesar × D. trilamellatum.
2503 Dendrobium Margaret Paxton × D. Champagne.
1599 Arachnis Catherine × *Phalaenopsis denevei*.
1597 *Arachnis hookeriana* var. *luteola* × *Phalaenopsis serpentilingua*.
2291 Vanda Tan Chay Yan × Vandanthe Ellen Noa.
2739 Dendrobium Champagne × *D. Aries*.
1780 Aranda Lucy Laycock × *Vanda luzonica*.
2521 Vanda Norbert Alphonso × *Phalaenopsis denevei*.
1921 *Cypripedium glaucophyllum* × *C. philippense*.
3093 *Dendrobium affine* × D. Lady Hamilton.
1891 Vanda Ruby Prince × *V. insignis*.

72. During the year Gardens-raised hybrids won the following awards of the Malayan Orchid Society:

BGS—

2134/7 Dendrobium Noor Aishah 'Singapura', *Award of Merit*.
2432/3 Dendrobium Sonia Tan, *Preliminary Certificate*.
2502/1 Dendrobium Sri Temasek, *Preliminary Certificate*.
1649/1 Arachnopsis Helen Khoo 'Star Beauty', *Award of Merit*.
2654/1 Arachnopsis Napier 'Brown Beauty', *Award of Merit*.
2376/1 Aranthera Beatrice Ng. *Preliminary Certificate*.

and at the Malayan Orchid Society Show in September, the Challenge Cup for the best Malayan hybrid flowering for the first time.

BGS 2654 Arachnopsis Napier (Arachnopsis Eric Holttum × *Phalaenopsis denevei*).

73. The display section of the orchid nursery was kept supplied throughout the year with some 120–130 potted orchid plants in prime bloom. This continued to be a great attraction. A display was also put up for a fortnight during the Air Show at Paya Lebar airport.

XXIII. SUCCULENTS

74. The collection was added to by donation and acquisition of seeds under the seed exchange programme. There is an appreciable public interest in these plants. Proposal to construct a public display house for this kind of plant have unfortunately not been approved.

EXTENSION WORK

XXIV. SUPPLY OF PLANTING MATERIAL

75. A total of 13,391 plants, cuttings, lots of bulbs and packets of seeds were sold to the public. Revenue was $20,147 of which $16,672 was derived from the sale of orchid material and the balance from other plants.

76. The Gardens continued to supply planting material free of charge to Singapore Government departments, charitable institutions, government-aided schools and other official or quasi-official organisations. A total of 3,772 plants was made available. The Gardens also continued to loan potted plants to official and quasi-official departments and to welfare and cultural organisations for decoration at special occasions: 3,552 pots were so loaned.

XXV. EXHIBITION AND SHOWS

77. Mr. Alphonso was invited to judge at the Malayan Agrihorticultural Association show at Kuala Lumpur, 31st August to 3rd September. Once again the Botanic Gardens put up a non-competitive exhibit at this show. About 80 orchid plants, 50 cacti and succulents and 50 *Saintpaulia ionantha* were on display. This exhibit was not only a great attraction, but was an excellent demonstration of the horticultural research work of the Gardens which has no parallel in the Federation. The scope of the Gardens' exhibit in future is likely to be restricted because of the new federal plant import rules by which Singapore is treated as a foreign country.

78. The Gardens gave considerable assistance to the Singapore Gardening Society and the Malayan Orchid Society in staging their respective annual shows. Highlights of each show were the large non-competitive landscape groups put up by the Gardens. Exhibits were also put up at the Penang Gardening Society annual show, the Selangor Orchid Society Show, and new hybrids were regularly exhibited at the Malayan Orchid Society's monthly meetings.

79. Besides the local exhibitions Gardens orchid hybrids were shown overseas at: The Pakistan Flower Show, Karachi; Delhi Flower Show, India; Johannesburg Autumn Flower Show, South Africa; Philippine Orchid Society Annual Show, Manila; Transvaal Horticultural Show, South Africa; Chelsea Flower Show, London; City of Glasgow Flower Show, Scotland; and the Sydney Orchid Festival, Australia. Acknowledgement is here made to Messrs. BOAC, QANTAS and Air India who flew certain of the consignments free of charge.

XXVI. SINGAPORE GARDENING SOCIETY

80. Mr. H. M. Burkill and Mr. A. G. Alphonso were respectively President and Vice-President for the year 1961/62. Regular monthly meetings seven of which were in the Gardens were held for members and conducted by Gardens' officers. Demonstrations were also arranged in the Gardens for 'Kebuns' (private gardeners) on topical matters of interest such as burning soil, vegetative propagation, insecticide and fungicide spraying. Several members of the Gardens' staff assisted as judges at the Society's annual show.

XXVII. MALAYAN ORCHID SOCIETY

81. Mr. A. G. Alphonso served on the committee for the year 1961/62. Mr. Bajuri was Hon. Secretary of the Society's Panel of Judges. The Gardens gave strong support to the Society's monthly exhibitions and annual show, and contributed regularly descriptions of new hybrids for publication in the Malayan Orchid Review.

XXVIII. FILM PRODUCTION

82. One studio has from time to time come 'on location' in the Gardens, but the tempo of production of previous years has slackened.

XXIX. ADVISORY

83. Many visits were paid by the horticultural staff to advise on planting schemes in school (80 schools sought advice) and hospital compounds, at Police Stations and at charitable institutions. Advice was given to the Public Works Department in connection with a number of their projects including the Industrial Development Project, Jurong, The Prison Reformation Training Centre, Changi, The National Library, and at 'Temasek', Kuala Lumpur. The Director and Curator both paid visits to Pulau Senang Settlement to offer advice on planting. A quantity of irritant plant juices and irritant plant hairs was prepared for the Police as an experiment in curbing unruly crowds to exchange baton and broken heads for a more sardonic touch. This interesting experiment has however not been carried out.

84. As much advice and more was tendered by telephone and correspondence, not a little of which has gone to the Federation of Malaya. Many requests for advice related to the safety of trees adjacent to buildings.

85. The botanical staff continued to deal with enquiries relating to identity and uses of plants. Much interest was shown in marine algae and in edible mushroom cultivation, fostered, no doubt, by the spate of *Lepiota* poisoning recorded above. The Gardens collaborated with the Health Authorities and the Pharmacology Department of the University of Singapore over this poisoning, and issued a press release describing how to distinguish between safe and unsafe species.

86. The very great amount of enquiries received is a good and satisfying indication of the service the Gardens plays for the public weal. The extent of these enquiries is certainly increasing. Though the primary function of the Gardens is research, the culmination of research is knowledge from out of which enquiries can be correctly answered and advice reliably given.

STAFF OF BOTANIC GARDENS 1961

Divisions I and II and Technical Posts of Division III

Appointment	*Holder*	*Notes*
Director	H. M. Burkill, M.A. (Cantab.), F.L.S.	
Botanists	1. J. Sinclair, B.Sc. (Edin.)	Keeper of Herbarium
	2. Chew Wee-Lek, B.Sc. (Malaya), Ph.D. (Cantab.)	Assistant to Director
	3. Miss Chang Kiaw Lan, B.Sc. (Malaya)	
Curators	1. A. G. Alphonso	
	2. Lam Hin Cheng	
Librarian	Tan Kim Ho, B.Sc. (Malaya)	
Executive Officer ..	R. S. Mani	
Laboratory Assistant (Special Grade) ..	Bajuri bin Sappan	
Horticultural Assistant	*Vacant*	To 17/5
	Ang Gek Choo	W.e.f. 18/5
Herbarium and Museum Assistant ..	Mohamed Shah bin Haji Mohamed Nur	
Artist	Juraimi bin Samsuri	

METEOROLOGICAL REPORT

BOTANIC GARDENS, SINGAPORE

Reading daily at 9.30 a.m. local time at Gardens Office

1961	Total Rainfall	Highest fall in 24 hrs.	No. of days rainfall	Mean Max. Temp.	Highest Max. Temp.	Mean Min. Temp.	Lowest Min. Temp.	Mean Temp. Dry Bulb	Mean Temp. Wet Bulb	Mean R.H.
	ins. *	ins.		°F	°F	°F	°F	°F	°F	%
January	6.56 (11.20)	0.83	14	85.3	91.0	73.2	71.0	78.9	75.1	84.0
February	3.96 (7.28)	1.66	15	87.7	92.2	74.2	71.0	80.0	76.0	84.0
March	8.70 (8.36)	1.49	16	89.1	93.0	74.9	72.5	79.3	77.4	82.0
April	7.35 (8.13)	2.55	18	89.4	93.9	75.9	73.2	82.2	78.4	83.4
May	5.21 (7.53)	1.82	13	90.3	94.5	76.6	72.8	82.6	79.6	87.5
June	6.32 (6.70)	2.13	12	90.0	93.6	75.7	72.7	80.2	79.9	84.7
July	4.27 (6.18)	1.38	14	88.7	94.3	76.1	70.8	82.3	78.6	83.2
August	1.46 (7.15)	0.69	5	88.2	91.0	76.2	71.0	82.1	77.3	78.6
September	4.49 (7.58)	1.80	12	89.5	92.6	78.5	71.0	80.0	77.4	77.7
October	5.93 (7.94)	1.04	15	86.3	92.4	74.5	71.5	82.2	77.4	80.7
November	10.67 (10.47)	0.95	23	88.3	91.0	73.8	71.0	82.2	77.6	81.6
December	4.10 (9.81)	0.53	23	86.5	89.0	73.7	72.0	80.3	76.6	85.8
Total/Mean ..	69.02 (98.30)	..	180	88.2 (31.2 C)	89.9 (32.2°C)	75.3 (24.0 °C)	71.7 (22.1 °C)	81.0 (27.2 C)	77.6 (25.3°C)	82.8

* Mean for the period 1914—1961 (48 years).

METEOROLOGICAL REPORT

Botanic Gardens, Singapore, 1961

Reading daily at 8.00 a.m. local time at Orchid Enclosure from 1-1-61

1961	Total Rainfall	Highest fall in 24 hours	No. of days Rainfall	Mean Max. Temp.	Highest Max. Temp.	Mean Min. Temp.	Lowest Min. Temp.	Mean Temp. Dry Bulb	Mean Temp. Wet Bulb	Mean R.H.	Mean Min. Grass Temp.	Mean Earth Temp. 4"	Mean Earth Temp. 1'	Mean Earth Temp. 4'	Mean Solar Rad. Thermometer
	ins.	ins.		°F	°F	°F	°F	°F	°F	%	°F	°F	°F	°F	°F
January	6.58	1.46	15	84.6	90.0	72.5	70.3	75.7	74.7	95.0	71.4	77.8	79.8	81.3	134.0
February ..	4.71	1.70	14	86.8	90.0	72.8	69.8	75.2	74.2	96.0	71.3	79.5	81.8	82.4	136.5
March	8.27	1.40	15	88.1	91.5	73.6	71.0	76.2	75.3	97.0	72.9	81.6	83.7	83.5	142.2
April	6.92	2.60	15	87.1	90.4	75.0	72.2	77.2	76.5	96.6	74.4	81.0	84.4	84.7	144.9
May	3.09	1.63	11	88.4	91.4	75.4	73.0	78.3	77.3	95.0	74.9	..	84.2	84.5	135.9
June	5.37	2.21	13	86.6	90.0	74.1	70.9	77.5	76.5	94.6	74.3	..	83.0	83.8	123.9
July	6.12	1.50	13	86.9	90.8	74.2	70.0	77.2	76.4	95.8	73.2	..	82.9	83.7	..
August	1.25	0.60	5	87.1	90.2	73.4	71.1	77.2	76.1	95.0	72.8	..	83.4	83.5	..
September ..	4.09	1.64	12	87.8	90.5	73.1	69.1	76.8	75.8	95.5	72.9	82.2	84.2	84.3	147.3
October	3.33	0.98	13	88.0	90.5	73.9	71.0	76.7	75.8	93.5	71.8	81.1	83.6	84.1	139.6
November ..	10.97	1.09	23	86.6	90.7	73.2	71.8	75.8	75.2	95.9	70.5	79.9	82.1	83.2	138.2
December ..	4.02	0.69	22	85.4	89.7	73.1	71.5	75.7	75.0	96.3	71.3	79.8	81.7	82.7	141.6
Total/Mean ..	64.72	..	171	87.8 (31.0 C)	90.5 (32.5°C)	73.7 (22.8°C)	71.0 (21.7°C)	76.6 (24.8°C)	75.7 (24.3°C)	95.5	72.6 (22.6°C)	80.1 (26.7°C)	82.9 (28.3°C)	83.4 (28.6°C)	138.4 (59.1 C)

METEOROLOGICAL REPORT

SUMMIT BUKIT TIMAH, ALTITUDE 581 FEET

Reading daily at 8.00 a.m. local time August to December, 1961, only

1961	Total Rainfall	Highest fall in 24 hrs.	No. of days Rainfall	Mean Max. Temp.	Highest Max. Temp.	Mean Min. Temp.	Lowest Min. Temp.	Mean Temp. Dry Bulb	Mean Temp. Wet Bulb	Mean Relative Humidity
	ins.	ins.		°F	°F	°F	°F	°F	°F	%
August	2.43	1.08	4	85.2	89.3	74.0	65.0	77.2	75.1	90.3
September	8.65	1.78	13	86.2	89.2	74.4	71.5	78.0	75.5	88.4
October	3.03	0.51	12	85.9	89.9	74.5	70.3	77.8	74.8	86.3
November ..	15.26	2.60	19	74.7	88.2	72.9	69.1	76.9	74.7	88.9
December	8.75	1.87	20	83.1	88.5	72.3	70.1	75.5	74.0	93.7
Total/Mean ..	38.12	..	68	83.0 (28.3°C)	89.0 (31.7°C)	75.6 (24.2°C)	67.2 (19.6°C)	77.1 (25.1°C)	74.8 (23.8°C)	89.5

SUMMARY OF DISTRIBUTION OF HERBARIUM SPECIMENS ON EXCHANGE AND LOAN

	Exchange		Loan	
	In	Out	In	Out
Adelaide	..	2	..	..
Arnold Aboretum	..	233	899	..
Bailey Hortorium	..	2	..	..
Bangkok	..	52	..	..
Beaudette Foundation	..	6	..	..
Berlin	..	36	..	..
Bogor	396	140	..	..
Brisbane	..	9	..	..
British Colombia, University of	25	..	..	..
British Museum	..	103	..	..
California, University of	..	9	239	..
Cambridge	30	..	..	..
Canberra, C.S.I.R.O.	86	..	..	706
Copenhagen	..	7	..	..
Dehra Dun	..	10	..	..
Delhi University	..	6	..	..
Duke University	..	4	..	..
Edinburgh	..	228	..	..
Florence	..	22	..	..
Geneva	..	10	..	..
Goteborg	..	7	..	..
Groningen	..	2	..	..
Hawaii, University of	..	9	..	..
Kepong	435	13	..	..
Kew	..	553	1	..
Kuching	322	182	80	..
Lae	130	300	..	..
Leiden	90	437	61	950
Malacca, Tropical Fish Culture Research Institute	..	7	..	..
Malaya, University of	..	43	..	..
Manila	160	70	..	..
Michigan University	..	14	..	..
Minnesota University	..	1	..	..
Montreal	..	16	..	..
New York	..	36	..	..
Philippines, University of	..	13	..	..
Sandakan	861	87	..	..
Tokyo	289	..	..	..
Uppsala	..	2	..	..
Wycherley, Dr. P. R.	..	1	..	..
Total	2,824	2,672	1,280	1,656

INSTITUTIONS AND PRIVATE COLLECTIONS FROM WHOM PLANTS AND SEEDS WERE RECEIVED IN 1961

Algeria	Ministry of Agriculture and Forests, Algiers.
Argentine	Instituto de Botanica Agricola, Buenos Aires.
Australia	Mr. W. B. Muir, Queensland.
Brunei	Dr. K. F. D Sweetman, Seria.
Bulgaria	Academy of Sciences, Sofia Botanic Gardens of the University, Sofia.
Canada	Botanical Garden, Montreal.
Cook Islands	Count F. M. Knuth, Rarotonga.
Costa Rica	Dr. A. J. Hansen, Turrialba.
Eire	National Botanic Gardens, Dublin.
Federation of Malaya	Mr. Lee Ewe Boon, Alor Star; Mr. F. G. H. Allen, Ipoh; Mrs. H. Jones, Petaling Jaya; Mr. M. E. L. Robey, Malacca; Botanic Gardens, Penang; Mr. C. C. P. Wilkins, Batu Gajah; Mr. Philip Kuok, Johore Bahru; Tuan Haji Ahmad, Anak Bukit; Mr. Leong Hoi Choon, Ipoh; Dato Sir Mahmud bin Mat, Kuantan; Dr. (Miss) Soo Kim Lan, Kuala Lumpur.
France	Jardin Botanique, Dijon; Jardin Botanique, Lyon; Museum National d'Histoire Naturelle, Paris; Ms. Vilmorin-Andrieur, Verrieres-le-Buisson; Jardin Botanique, Strasbourg; Jardin Botanique, Anders; Station de Botanique et de Pathologie Vegetal, Antibes; Jardin Botanique, Nantes; Jardin Botanique, Marseilles; M. J. Marnier Lapostoole, St. Jean Cap Ferrat; Ministiere de l'Agriculture, Antibes; Jardin Botanique, Besancon; Dr. Maurice Boussard, Saint Mihiel.
Germany	Botanisher Garten der Universitat, Erlangen; Botanischer Garten der Justus-Liebig Universitat, Giessen; Botanischer Garten, Kassel; Botanischer Garten, Munich; Botanischer Garten der Universitat, Munster; Botanischer Garten der Technischen Hochschule, Braunschwieg; Botanischer Garten, Hamburg; Botanischer Garten der Technischen Hochschule, Dresden; Botanischer Gartens und Museums, Berlin; Botanischer Garten der Pedagogischen Hochschule, Potsdam; Botanischer Garten der Karl Marx Universitat, Leipzig.
Ghana	University College, Lagos.
Greece	Botanic Garden of the University, Athens.
Hungary	University, Debrecen; University, Budapest; Gyogynoveny Kutato Lutezet, Budapest; Institute of Sylviculture, Budapest.
Italy	Orto Botanico dell'Universita, Modena; Amministrazione Borromeo, Milan; Instituto Botanico dell'Universita, Florence; Villa Taranto Gardens, Lake Maggiore; Orto Botanico, Udine; Orto Botanico, Genoa.
Japan	Kyoto Takeda Herbal Gardens.
Kenya	Parks Department, Nairobi.
Mauritius	Sugar Industry Research Institute, Reduit.
Nepal	Dr. G. A. C. Herklots, Kathmandu.
New Guinea	Department of Forests, Lae.
New Zealand	Mr. G. N. Sheldon, Christchurch.
North Borneo	Mrs. Collinette, Jesselton.
Norway	University, Oslo.
Philippine Islands	Department of Forests, Manila.

Poland	University, Wroclaw; Medical Academy, Poznan; Institut de Pharmacognosie, Varsovie.
Portugal	Agricola do Ultramar, Lisbon; University, Coimbra; Instituto de Botanica, Porto.
Roumania	Agricultural Institute, Cracow; University, Bucarest; University, Cluj.
Sarawak	Mr. J. Seal, Kuching.
Singapore	Mrs. M. Lewis; Mr. Leong Chun Wei; Mr. Robert Wee Soon Bee; Mr. Choo Yeok Koon; Mr. James Lee; Mr. Tan Chye Siam; Mr. E. Klass; Mr. George Chan; Mr. D. C. Doo; Mr. Yap Cheng Beng; Mr. Tan Hoon Siang; Mrs. MacDougall.
South Africa	Mrs. F. van Eeden, Magoeboskloof; Mrs. C. F. Todd, Johannesburg.
Spain	Municipal Parks and Gardens, Barcelona.
Sweden	Bergianska Tradgarten, Stockholm.
Trinidad	Agricultural Department.
Tunisia	Service Botanique et Agronomique, Ariana.
United Kingdom	University of St. Andrews; University of Birmingham; Royal Horticultural Society Gardens, Wisley; Eden (Battle) Ltd., Battle; Royal Botanic Garden, Edinburgh; University College, Cardiff; Royal Botanic Gardens, Kew; Royal Society, London.
United States of America	California Jungle Gardens, Los Angeles; Boyce Thompson South-western Arboretum, Arizona; Mr. D. H. Nicolson, Cornell University; Garfield Park Conservatory, Chicago; Mr. Ernest de Saram, Florida; United Fruit Coy., Boston; Foster Botanical Gardens, Honolulu; Dr. Degener, Waialua, Hawaii.
Union of Soviet Socialist Republics	Academy of Sciences, Georgia; University of Latvia, Riga; Academy of Sciences, Alma-Ata; Academy of Sciences, Ashkhabad; Institute for Experimental Biology, Tallinn.
Yugoslavia	University, Zagreb.

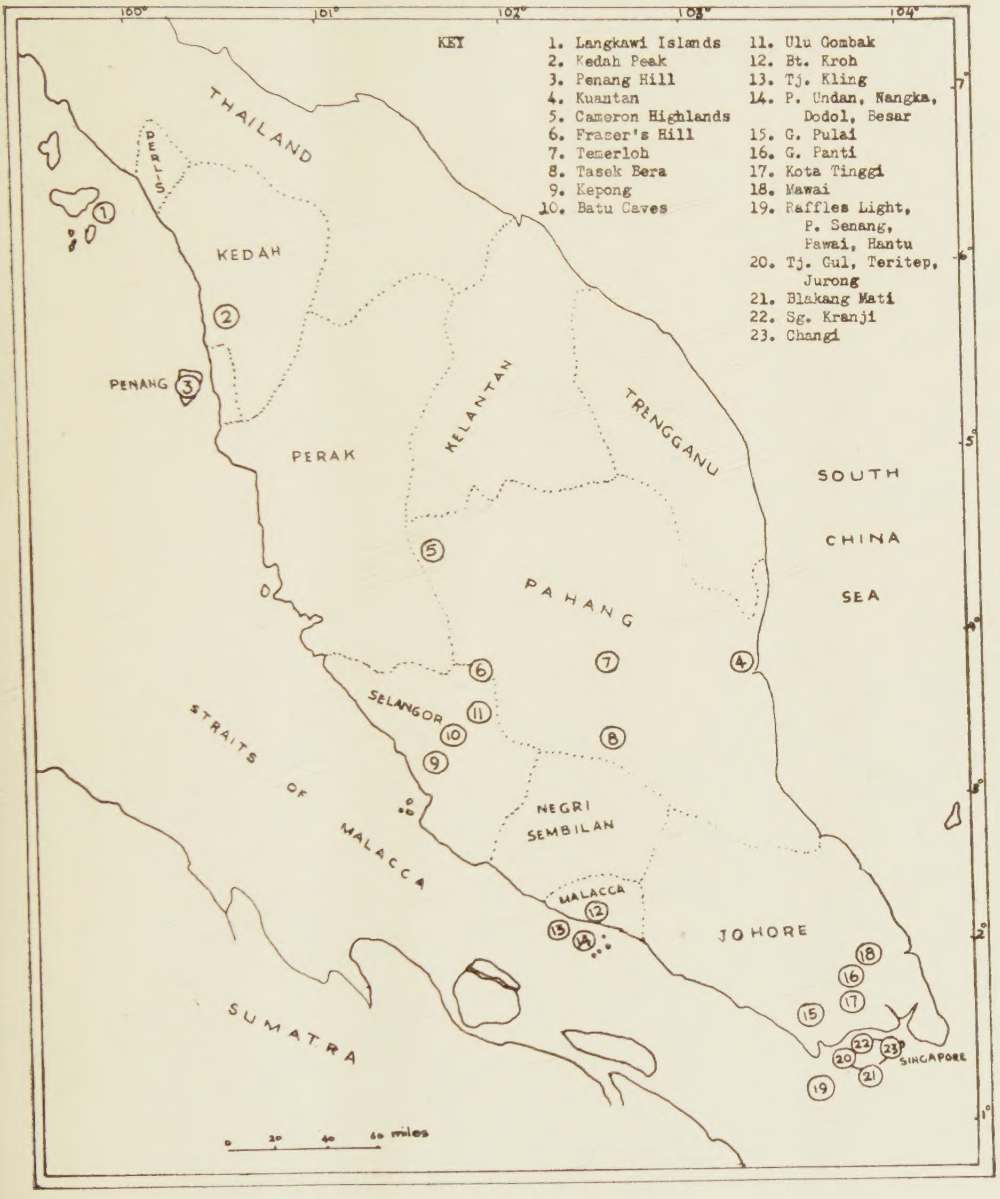
INSTITUTES AND PRIVATE COLLECTORS TO WHOM PLANTS AND SEEDS HAVE BEEN SENT IN 1961

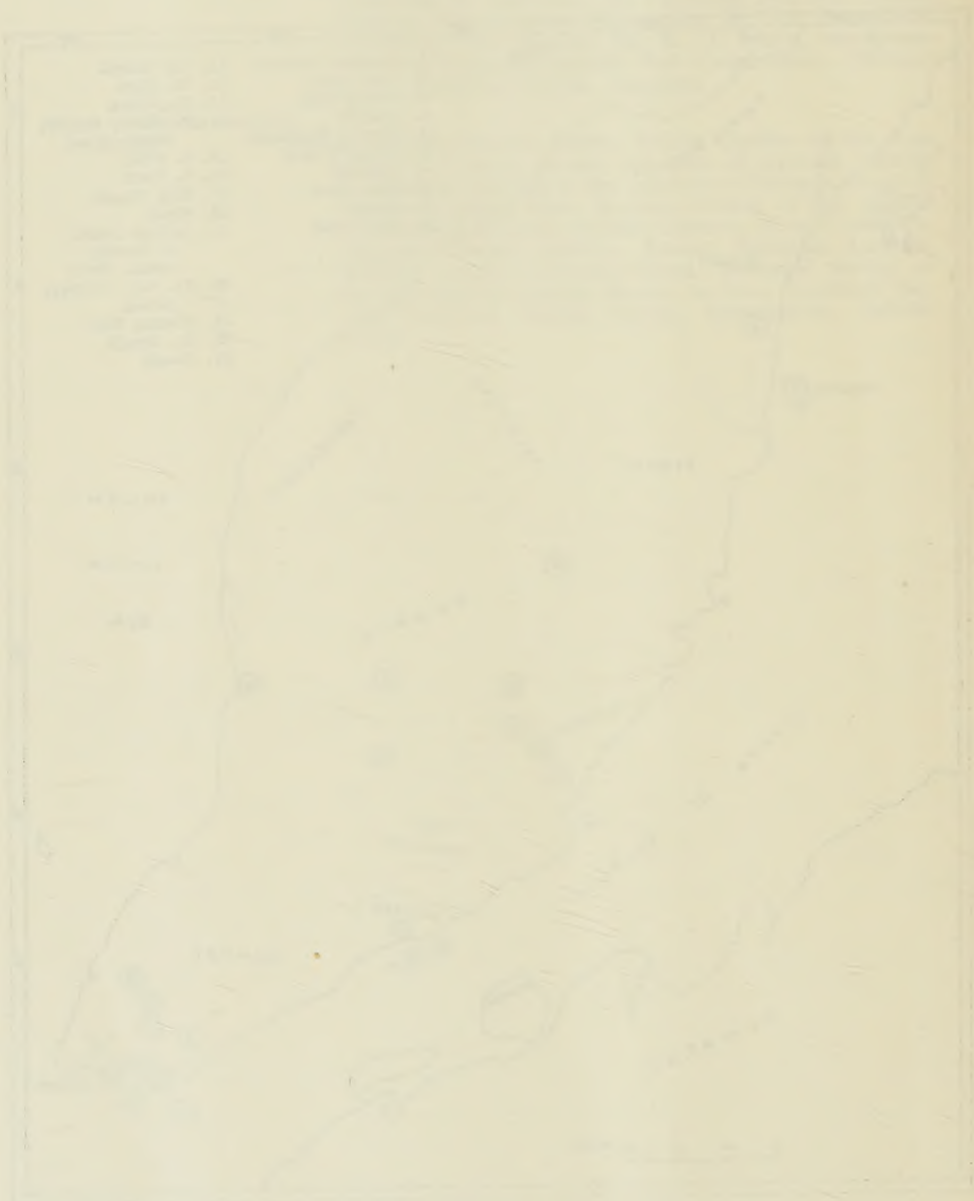
Algeria	Institut Scientifique Cherifien, Rabat; Jardin d'Essais du Hamma.
Argentina	Instituto de Botanica Agricola, Buenos Aires.
Australia	Botanic Gardens, Brisbane; Botanic Gardens, Melbourne; Botanic Gardens, Adelaide; Parks and Reserves Department, Townsville.
Austria	Botanischer Garden, Vienna; Botanischer Garten, Graz.
Belgium	Plantentuin, Antwerp.
Bermuda	Department of Agriculture, Paget East.
Brunei	State Agricultural Office; Dr. K. F. D. Sweetman, Seria.
Canada	Botanical Garden, Montreal.
Cook Islands	Department of Agriculture, Rarotonga.
Costa Rica	Dr. A. J. Hansen, Turrialba.
Czechoslovakia	Botanic Gardens, Brno; Botanic Gardens of Charles University, Prague; Institutus Pedagogici, Kosice; Botanic Garden of the University, Bratislava; Mr. Davidik Vaclav; Institute of Natural Sciences, Prague; Vyzkummy Ustav-Krsnivassky, Troubsko u Byna; Botanic Gardens of the University, Brno; Mr. R. Kotoucek; Botanic Gardens, Liberec; The Research Station, Sumperk-Temenice.
Federation of Malaya	Forest Research Institute, Kepong; Dunlop Malayan Estates Ltd., Malacca; Montford Boys Home, Batu Tiga; Department of Chemistry, Petaling Jaya; Rubber Research Institute of Malaya, Kuala Lumpur; Department of Botany, University of Malaya, Kuala Lumpur; Botanic Gardens, Penang; Istana Gardens, Johore Bahru; Mr. Philip Kuok, Johore Bahru; Mr. Leong Hoi Choon, Ipoh; Mr. Lee Ewe Boon, O.B.E., Alor Star; Dato Sir Mahmud bin Mat, Kuantan.
Finland	Botanical Garden, Turku.
France	Jardin Botanique, Caen; Dr. Maurice Boussard, Saint-Mihiel; Jardin Botanique, Besancon; Museum National d'Histoire Naturelle, Paris; L'Institut de Botanique de la Faculte des Sciences, Strasbourg; Jardin Botanique de l'Universite, Toulouse; Jardin des Plantes de l'Universite, Montpellier; Jardin Botanique, Nancy; Ministry of Agriculture, Cap d'Antibes.
Germany	Botanischer Garten der Johannes Gutenberg Universitat, Mainz; Botanischer Garten der Westfailschen Landesuniversitat, Munster; Botanic Gardens Berlin; Institute for Forest Botany, Berlin; Botanic Gardens, Potsdam; Botanic Gardens, Darmstadt; Botanic Gardens, Munich; Botanic Gardens of the Technical Highschool, Dresden; Botanic Gardens of the Technical Highschool, Karlsruhe; Botanic Gardens of the University, Erlangen; Botanic Gardens, Essen; Botanic Gardens, Dortmund; Botanic Gardens, Frankfurt; Botanic Gardens of Halle University; Botanic Gardens of the University, Tubingen; Botanic Gardens of the University, Bonn; Pflanzenphysiologisches Institut der Frein Universitat, Berlin; Botanic Gardens, Hamburg; University Botanic Gardens, Rostock; University Botanic Gardens Wurzburg; Botanic Gardens, Oberholz.
Holland	Rijksuniversity, Leiden; Botanic Gardens, Delft; Laboratory for Microbiology, Wageningen.
Hongkong	Gardens Division, Urban Services Department.

Hungary	Botanic Gardens of the Academy of Sciences, Vacratot; University of Agricultural Science, Godollo; Botanic Gardens, Pecs; University Botanic Gardens, Budapest; University, Szeged.
India	Indian Botanic Gardens, Calcutta; National Botanic Gardens, Lucknow; Sandoz (India) Ltd., Rohohet.
Italy	Botany Department of the University, Catania; Botany Department of the University, Modena; Botanic Gardens, Naples; Botanic Gardens of the University, Pisa.
Japan	National Kyushu Regional Agricultural Experiment Station, Tansegashima; Kyoto Takeda Herbal Gardens; Botanic Gardens of Osaka City University; Mr. Toshihiko Satake, Hiroshima; Mr. Yukio Miyazaki, Minami-izumachi Kamogun; Mr. Yoschumi Oka, Mutsuzaka.
Kenya	Parks Department, Nairobi; Messrs. Grahame Bell Ltd., Nairobi.
Malta	Argotti Botanic Gardens.
Mauritius	Sugar Industry Research Institute, Reduit.
Mexico	Ministry of Agriculture.
New Guinea	Forest Department, Lae.
New Zealand	Parks and Reserves Department, Christchurch; Mr. G. Jamieson, Napier; College of Technology, Zaria.
Nigeria	University College, Lagos.
North Borneo	Forest Department, Sandakan, Town Board, Jesselton.
Portugal	Instituto Botanico da Universidade, Coimbra; Estacio Agronomica Nacional, Sacavem.
Poland	Hortus Plantarum Academiae medicae, Warsaw; Botanic Garden of the University, Wraclaw; Botanic Garden of the University, Poznan; Szkoly Glownez Gospwiez Skiego Arboretum; Botanic Gardens of the University, Cracow.
Rhodesia	Mr. H. J. Blackwood Murphy, Melsetters; Mr. B. C. N. Mountain, Umtali.
Sarawak	Mr. J. Seal, Kuching.
Singapore	H. E. Yang di-Pertuan Negara; Mr. A. J. Braga; Mrs. M. Lewis; Mr. Leong Chun Wei; Mr. D. C. Doo; Mr. Choo Yeok Koon; Mr. Yap Cheng Beng; Mr. E. Klass.
South Africa	Mrs. Ulay van Eden, Tzaneen; Daleside Estate Nurseries, Kliprivier; Mr. P. Bell, Richmond.
Spain	Instituto Botanico, Barcelona.
Sweden	Botanic Garden of the University, Uppsala; Bergianska Tradgarden, Stockholm; University Botanic Garden, Lund.
Switzerland	Botanic Garden, St. Gallen.
Tunis	Service Botanique, Ariana.
Uganda	Department of Agriculture, Entebbe.
United Kingdom	Royal Botanic Garden, Edinburgh; Major V. F. Howell, Cobham; University College of North Wales, Bangor; Col. J. A. MacRae, Kyle of Lochalsh; Department of Botany, St. Andrews University; David Sanders Orchids Ltd., East Grinstead; Botany Department, University College of Southampton; St. Wulfromis Secondary School, Grantham.

United States of America	Department of Plant Pathology, University of California; Botany Department, Cornell University; Botanic Gardens, University of California; The Flowering Tree Man, Stuart, Florida; Mr. E. Lowe, Huntingdon, W. Va; Department of Botany, Los Angeles; Mr. R. D. Pearce, Hendersonville, N. Carolina; Garfield Park Conservatory, Chicago; Foster Botanical Garden, Honolulu.
Union of Soviet Socialist Republics ...	Mr. Theodor Balams, Latvia; Botanic Gardens of the Academy of Sciences, Erevan; Academy of Sciences, Ashkhabad; Botanic Gardens of the Academy of Sciences, Moscow; Botanic Gardens, Kiev; Botanic Gardens of the Ukraine Academy of Sciences; Botanic Gardens of the University, Moscow; Botanic Gardens, Batum; Biological Institute, Kannas; Botanic Gardens, Tomsk; Botanical Section of the Pedological Institute Rostov on Don; University Botanic Gardens, Latvia; Hortus Pomologicus, Dobele, Latvia.

MAP SHOWING LOCATION OF MALAYAN PLACE NAMES MENTIONED IN THE REPORT





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